Notebook Series -- Notebooks by Experimenters Other Than Edison
Navy and Wartime Research Experiments -- A. M. Kennedy Books
Notebook, N-17-04-05

This notebook was used by Absalom M. Kennedy in April 1917 for notes on experimental work for the U.S. Navy performed under the direction of Edison during World War I. The book consists primarily of notes on experiments involving amplifiers, audion circuits, transmitters, and transmitter parts. Also included are notes describing experiments with the "Edison Effect." Several entries include notations by Edison or remarks by Kennedy about his opinions and suggestions. The notes indicate that E. Rowland Dawson and Joe Meilner also worked on these experiments and that some of them took place at sea near Sandy Hook and Red Bank, New Jersey. The front cover is labeled "Experiments #3 March 21 -." The pages are unnumbered, and some have been removed from the middle of the book. Approximately 120 pages have been used.

17-04-05

Jewett.
Coebitt.
Shreve.

69593
Acme Co.,
MFG. STATIONERS,
96 JOHN ST.
AND
19 PLATT ST.
NEW YORK.

On unsoldering input coil and connecting back by touching terminals, got awful dynamo noise from receiver, probably due to imperfect contacts.

Tried to get better contacts

Experiments with W.E. 3 stage Amplifier.

(1) 1 Switch Low - no switch high
Rheostat 9000.

Door open	60
Door closed	42

(2) Then disconnected W.E. output coil and substituted Bunnell 520-100

Door open	58
Door closed	26

(3) Then unsoldered contacts of input coil and put back by unwrapping.

Receiver makes awful dynamo noise so that phonograph can not be heard.

(4) Bent over these contacts and clamped with pliers. Noise same as before.

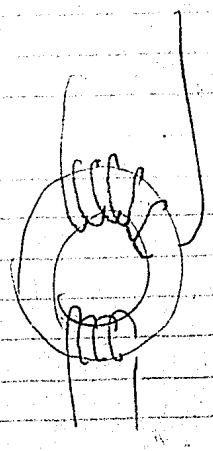
(5) Connected Bunnell.
11-2800 Coil in as input.
Door Open hear to 16
Door closed " " 2

Mr. Edison decided that the Bunnell coils were inefficient as compared with the Western Electric.

Took #47A (Dew #9) (1 to 1 ratio) apart. Superficial examination shows a closed circular iron core wound with 4 coils of about #26 wire on a circular core insulated a coarse woven cloth like cheese cloth between.

Mr. E then had me telephone N.E. Co. (Mr. Jewett was out - got Mr. Colpitt) to get winding specifications on #W192 and W188 repeating coils as input and output. These to be the size and number of turns each on

the primary and secondary coils and the dimensions and kind of iron in the core.



Winding Specifications
of W.E. Repeating Coils
#'s 188-W and 192-W.

W. 188. Output.
Impedance Ratio of windings
6000 to 2000.
Has 4 coils of which 3-4
and 7-8 are low and 1-2, 5-6
high.
3-4 and 7-8 each has 1150 turns
#25, single cotton covered
copper wire.
1-2 & 5-6, each has 2000 turns
#31 single cotton covered
copper wire.

Core of silicon steel punchings.

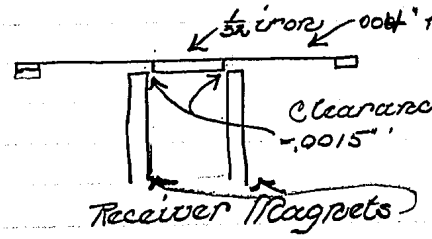
W192. Input

Impedance Ratio of windings = 960-600,000.

Coils 1-2 & 5-6 are made up of 6 sections each containing 45 turns black enamel and silk insulated #19 copper wire or 270 turns for the two.
Coils 3-4 & 7-8 are wound over these in 6 sections each containing 1160 turns, #32 Black enamel and silk insulated copper wire

Core of silicon steel.

Test of Special Receiver.



Used 3 stage audion
1st switch Row
2nd " High
Rostat at 9000

With regular Beel receiver
Door open 60
Door closed 38
With special Receiver
Door open 50
Door closed 18
Readjusted This -.010" farther away from magnets
Door open 54
Door closed can not distinguish
The quality here is too fine, gives a prolonged note rather than the clean, clear articulation

Then adjusted so that iron was .005½" closer to magnets than 1st time

Door Open to 60
" Closed to 52

With regular Bell Receiver as transmitter

Door Open to 60
Door Closed to 40

Special Receiver as transmitter adjusted so that armature is .015" within magnets

Door Open to 54
Door Closed to 38

Adjusted back so that the armature was .005" within the magnets —

Door Open to 60
Door Closed to 50

Used Bell Nierman Transmitter

Door Open to 60
Door Closed to 56

bread
family food
cook of dressing

Quality Test of Magnetic Transmitters

Door open - Standing at phone
Reading

Weremans Transmitter	5%
Standard Bell Receiver	10%
Meilners Transmitter	25%

In all of the above I could hear practically only the vowel sounds. Davidson then came closer & spoke lower so as to bring out the consonants.

standing at door Reading

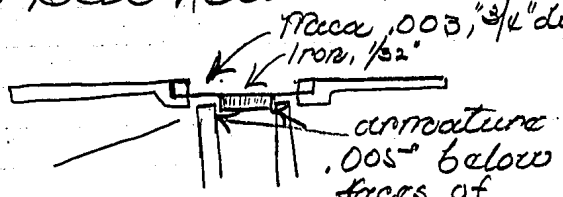
Meilners Transmitter	60%
Standard Bell	60%
Weremans Transmitter	50%

The above taken at 16 on box.

This is % of words got.

Used 3 stage amplifier.
1st Switch Rec - 2nd Switch high
Rheostat 9000

Test of 3/4" diaphragm on Bell Receiver.



Used 3 stage amplifier
1st switch Low
2nd " High
Rheostat 9960
Standard Bell Receiver.
Door Open 58
Door Closed 38.

New 3/4" diaphragm receiver
Door Open - can not hear -
Got Dawson to talk over.
Not very loud.

Sizes of interference tubes.

Vibrations per sec	Short inches	Long inches	Diameter of tube, inches	No
150	44	88	2	1
175	38	76	2	2
200	33	66	2	3
225	29.7	59.4	2	4
250	26.4	SAME.	2	5
275	24.2	48.4	2	6
300	22.	44.	2	7
× 325	20.42	40.84	2	8
350	18.84	37.68	2	9
375	17.67	35.34	2	10
400	16.5	33.	1½	11
425	15.58	31.16	1½	12
450	14.66	29.32	1½	13
475	13.93	27.86	1½	14
500	13.2	26.4	1	15
525	12.6	25.2	1	16
550	12.	24.	1	17
575	11.5	23.	1	18
600	11.	22.	1	19

C.J.

Test of 3 stage amplifier with new, rubber insulated input coil.

1st switch Low
2nd " High
Rheostat 9800

Hear noise to 60. This noise is a high roar and dynamo hum with noise like a pump perking which happens about 20 times per minute

Door open hear to 50
Door closed " can not distinguish phonograph.
This is not as good as before.
Then reversed connections back on output coil to be sure this was not the trouble.

Still get noise to 60
it is more nearly uniform

but apparently as loud as before.

With door closed can not distinguish phonograph.

Then tried

1st switch high

2nd " high

Rheostat 800

Noise increased. Could not hear phonograph with door closed.

Then tried rheostat at 400

Noise diminished

Could not distinguish phonograph with door closed.

Then tried 1st switch on low.

Noise about same

Could not distinguish phonograph.

Put 1st switch back on low, 2nd on high and the Rheostat at 9800

Put on ground connection.

Noise slightly diminished

Can not hear phonograph with

door closed.

Sunday morning.

1st switch Low
2nd " High
Rheostat 9 900

Noise slight. Cuts out 50
Door open hear to 60+
" closed " " 52
(Noise is uniform, slight hiss
mixed with a high pitched note)

[273]

Test of Amplifiers

① Used 3 stage, standard coils and connection.
1st switch Low
2nd switch High
Rheostat 9900.
Noise slight. Cuts out 50
Door open Hear to 60+
Door Closed Hear to 52
Noise is uniform and consists of a hiss mixed with a high pitched note. "Pump like sounds 8 per minute, probably condenser discharge noise.

② Then connected new hard rubber insulated coil in place of regular.
High pitched noise
Jarred, switches, rheostat and took off input and output wires. Still noise.
Found that by touching one side of input wire and ground noise was

diminished. Tried condenser in same place with same effect.

1st switch Low
2nd " High
Rheostat 9000.

Condenser, 1 mfd. input line, one side to ground connection (not grounded)
Input coil, W19V special moulded

Door Open to	60+
Door closed to	54.

(3) Put 2 mfd condenser around receiver in booth

Noise seems diminished

Door Open to	60
Door closed to	42

(4) Put 1 mfd condenser around input line & ground con.
Noise diminished ents out 54

Door Open	60
Door closed	58

C31J

Shunting receiver in booth cuts down noise but diminishes sensativeness.

(5) Put 1 mfd condenser around receiver in booth.
Door Open to 60
Door Closed to 46

(6) - With fresh A battery on amplifier, again tried effect of connecting mfd. condenser from one side of input line to ground connection.
Cut down noise, which was high pitch note 75%

(7) Then tried 1 mfd additional. noise changed from note to roar. Not as good.

(8) Then tried resistance across this (input line to ground connection),
Diminished noise, 10,000 ohms about to same amount as 1 mfd condenser. Cut this resistance by steps to 0.

This effect of shorting one side of input ~~with~~ line with ground connection is peculiar.

This ground connects to + A-B Battery and to the center of the primary coil of input coil. The + A-B Battery multiples in on one side of the filiment circuit of each audion lamp.

Diminishes noise only slightly.

(9) 10,000$^{\Omega}$ between input line and ground connection.
Door Open 60+
Door Closed 50

(10) - 5,000$^{\Omega}$ as above
Door Open 60+
Door Closed 54

(11) 2,000$^{\Omega}$ as above
Door Open 60+
" Closed 54

(12) 1,000$^{\Omega}$ as above
Door Open 60+
Door Closed 56

(13) Short circuit as above
Door Open 60+
Door Closed 56.

(14) Then changed this connection to other leg of input circuit marked T.

Door open 60+
" closed 56.

(15) Then connected input line direct to new input coil. 3 and 8 of this to connections in box this cutting out the shunt & series resistances in the input circuit

Makes peculiar roaring noise intermixed with regularly spaced clicks

Door open 30

While making above connections found solder loose on connection to #3 of input coil & resoldered it.

(16) Then connected input lines to input terminals of box. The high pitched note heard before had disappeared and in its place a roar of roaring sound interspersed with clicks.

Then connected one line to ground connection Noise diminished 80%

Door Open	60
Door closed	58

(17) Then replaced output coil of box by new insulated output coil.

Door open	60
Door closed	58

(18) Then connected 3 step audion box as input to 2 step as output

Bad case of churruping.

(19) Connected +A-B battery of 2 stage to ground connection of 3 stage sets.
Too quiet. I are afraid of it.

Door Open 30
Door closed 20

(20) Then removed connection from input line to ground connection
Circuit very quiet

Door Open. Can not hear.

(21) Then removed connection +A-B of 2 stage from ground connection of 3 stage.
Awful low pitch noise

(23) Then having removed above connection, connected +A-B battery of 2 stage and ground of 3 stage to ground.

CHJ

Door Open Can not hear phonograph

(24) Connects ground connection of 3 stage to #3 of 1st audion of 1 stage set
Door open to 30

(24) Ground of 3 stage set to #4 of 1st audion of 1 stage set.
Door open to 60+
Door closed to 54.

Suggestions for improvement of 6 stage amplifier circuit.

(1) Keep input and output apart, conductively, & inductively.

(2) Shield input circuit throughout. Also all cross connecting wires of lead covered cable

(3) Put B Battery of 2 stage set in tin lined box, thoroughly insulating the cells from each other.

(4) Mount units of 2 amplifier set on hard rubber and mount all on a board.

Test of Diaphragms.

Used 3 stage Amplifier.
1st switch at Low.
2nd " " High.
Rheostat 9900.
2 wires of input + grounded
Ground connection "

① Standard Bell Receiver as transmitter
Door Open 58.
Door Closed 48.

② Mica Diaphragm .025"
Iron Disc .010" × 1.00".
Disc Outside, Away from Magnet
Quality - Better than ①. Not so
much false ring + noise
Door Open 48
Door closed 38

Remove Mr. E
Speakers in Booth
& Sandy Hook

N.E. equalization of
tuned circuits between
audion bulbs & tune out
any note

③ Mica Diaphragm .002"
Iron disc on center .003" x 1".
Disc, outside, away from magnet.
Quality not as good as ② sharper.
Door Open 46
Door Closed 40

④ Mica Diaphragm .004"
Iron Disc on center .003" x 1".
Disc outside, away from magnet.
Quality little sharp.
Door Open 50
Door Closed 42

⑤ Mica Diaphragm .004"
Iron Disc on center .010" x 1"
Disc Outside, opposite magnets.
Quality unpleasant noisy.
Door Open 44
Door Closed 40

⑥ Diaphragm of steel .003"
Quality good & still natural.
Door Open 52
Door Closed 46

⑦ Mica Diaphragm
Iron center fitting between magnets, .001± clearance, projecting .005" below face of magnets, 1/32" thick.
Quality good. Clean.
Door Open 60
Door Closed 52

⑧ Mica Diaphragm .002
Special Iron Disc .020 x 1/16
Shaped around magnets
.002 clearance, .005" below face of magnets

Quality good
Door Open 50
Door Closed 50
Door Open 52

For noises - look out for-

1. Poor Contacts (Sing & Roar)
2. Induction from any source (Reproduces the source)
3. Coupling back between higher stage leads and lower. (Sings & chirrups)
4. Gassing of battery - either A or B (Hissing or roaring sound)
5. Unbalancing of lines as to length, particularly as to their capacity (Whistle & sing or change note on ringing)
6. Leaks between or around coils.
7. Audion tubes may be defective & should be replaced if suspected
8. Defective B Battery. Dry cells increase resistance & make noises

Test of plug in back of phonograph box.

1. Standard Bell Receiver Cork in phonograph hole
   Door open 50
   Door Closed 42
2. Standard Bell Receiver Hole Open 50
   Door Open 42

Plugging this hole in the phonograph therefore makes no difference

Various experiments made with output leads from 2 stage amplifier direct to receiver. Not on regular output coil.

3. Regular Bell Receiver. Plug open 54
   Door Open
   Door Closed 46

④ as ③ but with Beg Receiver
faced away from Phonograph
Door open 54
Door closed 44.

⑤ as ④ but with phonograph
~~turned to~~ wall.
~~Door~~ Open 54
~~Door~~ Closed 47

⑥ as ④ but with phonograph
in cabinet in Kennedy room
Door Open. 48
Door closed. 36

⑦ as ② but with mute in
horn of phonograph Can't hear.
Door open

⑧ as 7 but with phonograph
out of box
Door Open 54
Door Closed 42

⑨ as ⑦ but with lid of phonograph box open
Door open
Door closed

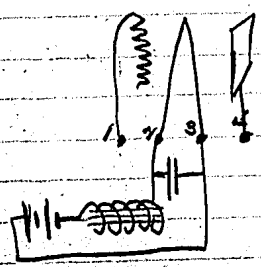
36
20

Experiments on Audion Amplifiers by Mr. Scrivers.

① Exchanging ground from + battery to - battery as shown on blue print changes and increases the noise.

~~② Putting an impedance in the A battery circuit reduced the hissing frying noise on the 3 stage amplifier.~~

② Putting an impedance in the A battery circuit of the 1st audion, cut down the hissing, frying noise. A condenser of 8 mfd. across the filament seemed also to help



In this the 3 stage set had a B coil on the 3d. audion in place of L as usual and had impedance coil between battery and 1st audion and 2 mfd condenser around filiments. Ground connection of set was grounded.

— 4 stage set.

① Input line disconnected to get noise in set.
Hear noise to 54

② Same as ① but with cover of 3 stage set on 50

③ Same as ② but with input line connected 58

④ Same circuits as ③
Door open, hear to 60
Door closed, hear to 46

⑤ Mr. Scriven then put the L type lamp back in the 3d stage of 3 stage amplifier and connected up this to receiver, having only a 3 stage set,
Door open, hear to 36
Door closed, " " can't hear

C.H.J

⑥ Mr. Dorneno then found the A battery low, and raised to normal value
Door open hear ft 38
Door closed hear ft 6

⑦ Mr. Dorneno then removed the ground connection
Door open hear to 48
Door closed " " 14

⑧ Mr. Dorneno then exchanged lamps on 3d audion
Door open, hear ft 46
" closed " " 14

⑨ Mr. Dorneno then put 1st switch on high.
Door open 58
Door closed (noise outside) 12 (?)

⑩ Mr. Dorneno then took off impedance & condenser & 1st lamp
Door open to 38
Door closed ft 22
More noise

Scriven

(11) Mr. Scriven reversed diaphragm on receiver & removed ring.
Door Open 60
Door Closed 52

(12) Repeated 11 to guard against mistake. 9 P.M.
Door Open 60
Door Closed 52

(13) 1st switch changed to High
Door Open 60
Door Closed 60

(14) As 13 but with Bell Receiver faced down on plate glass
Door Open 60
Door Closed 44

(15) As 13 but with muffler in horn of phonograph, box top open.
Door Open 60
Door Closed 54

(16) As 15 but with lid of box closed
Door Open 28
Door Closed Can't distinguish

(17) 1st amplifier Low
2nd " High
Rheostat 9900
3d stage B tube in place of L
Phonograph - standard
Door Open 60
Door Closed 56
(noise very little, Good)

(18) As 17 but with L tube in third stage.
Door Open 60
Door Closed 58

(19) Then began tests to localize & remove noise.
→ Removed input wires. Noise cut out at 40

(20) Input wires on noise 44

(22) Input wires off. Binding posts short circuited.
Noise 18

(23) Input wires on, extra impedance coil in 1st audion filament circuit
Noise 36

(24) Same as 23 but diaphragm removed from receiver at transmitter end.
Noise 38

(25) As 24 but with 8-mfd condenser across filament of 1st audion.
Noise 32

(26) As 25 but with Bell receiver, diaphragm out, across input terminals in place of input line
Noise 28

(27) As 26 but impedance coil in filament circuit of 2nd audion.
Noise 28
(Picked up dynamo noise)

(28) As 27 but with type B tube in 3d stage in place of type L
Noise 18

(29) As 28 but with impedance put in as 27 removed
Noise 18

(30) As 29 but with 4th stage audion added.
Door Open 60+
Door Closed 60+

(31) Noise reading of 31 with Bell Receiver, diaphragm removed connected across input terminals of 3 stage amplifier
Noise 58

C713

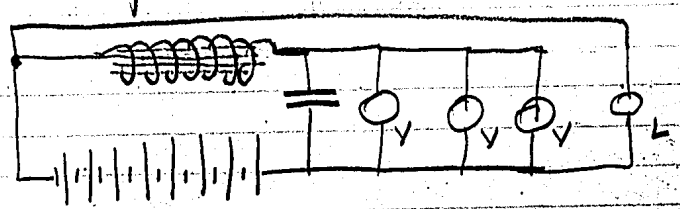
(32) As 30 but with Receiver ~~Cushion~~ down on plate glass
Door Open 60+
" Closed 60+

(33) As 30 but with muffler on phonograph, lid open
Door open 60+
Door Closed 60+

(34) As 33 but with lid of phonograph closed
Door Open. 60+
Door Closed. 54

Posts in 9 volt battery on 4th stage of amplifier.

With storage battery as B battery put high impedance coil in common with all V tubes, leaving L clear.
10 or 12 mfd condenser around battery and coil



Experiment of changing impedance coils of 3rd. and 4th stages.

With 4 stage amplifier as set up
Noise 60
With 4th & 3d stage impedance coils exchanged.
Just heard 60+

Completed test of 4 stage set.

Noise figure
Just heard at 60
Noise consists of slight fry or hiss, dynamo sound and an occasional click.

Efficiency
muffler in phonograph horn
Lid open -
Door open to
Door closed to Contact 60

So much noise around, impossible to read.

Test of Audibility Limit with 4 stage Audion.

① Muffler on Phonograph
Box lid closed
Door open 60+
Door closed 56

② As 1 but with Bell receiver in corner of Mulners Room
Door open 60+
Door closed 54
More noise than 1, probably because transmitter is closer in contact with board by being close to wall.

③ Same as ① but with Bell Receiver just outside door in Music Room. Door between Reynolds & Mulners room closed.
Door to music room open 30
Door " " " closed 0

Can not distinguish phonograph. Other noises conceal it.

④ Same as 3 but changed record to Fox trot.
Music Room Door Open 56
" " " Closed 52

⑤ Listened in for quality of music at D on box
Same position of person as in ④
Got 40% of the record.

⑥ Same as ⑤ but with box at O
Could get 60% of melody.

⑦ Same as ⑥ but person moved to end of shelf

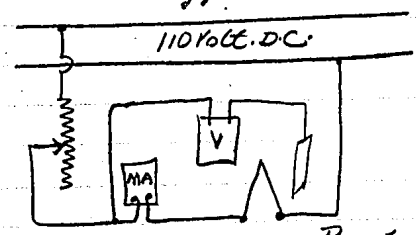
⑧ Same as 7 but with person out of music room, in

Relation of Readings of Receiver Shunt Boxes.

According to curve made out by Mr. Scriven, the readings of shunt boxes are relatively:

0	= 1	= 100 %	30	=	3¾ %
2	= 1.3	= 77	32	=	2.9
4	= 1.6	= 62.5	34	=	2.4
6	= 2.	= 50.	36	=	1.9
8	= 2.4	= 41½	38	=	1.5
10	= 3	= 33	40	=	1.25
12	= 3.7	= 27.	42	=	1.00
14	= 4.6	= 22	44	=	0.80
16	= 5.8	= 17	46	=	0.65
18	= 7.2	= 14	48	=	0.52
20	= 9	= 11	50	=	0.41
22	= 11.1	= 9	52	=	0.34
24	= 13.8	= 7½	54	=	0.27
26	= 17	= 6	56	=	0.21
28	= 21	= 4½	58	=	0.16
30	= 26.6	= 3¾	60	=	0.14

Experiments with Edison Effect.



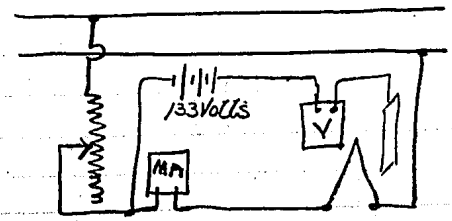
Current M.A.	Reading V-3 Volt scale O. Volt.	Difference	Reading V-150 Volt Scale O. Volt	Difference
.150 amp				
.160	.02 "	.02	.1	.1
.170	.09 "	.07	3	2.9
.180	.26 "	.17	9.5	6.5
.190	.62 "	.36	22.	12.5
.200	1.44 "	.82	38	16.
.210			44.	6.
.220			49	5.
.225			52.	3.

C. represent V. without Batt	Diff
.000285	
.000715	
.001708	
.00349	
.00675	
.00972	
.0139	
.01775	
.02120	
.02260	
.02400	

C. rep. V with 33 V. Battery
.000858
.00223
.00430
.00807
.01509
.02120
.02950
.03250
.05310
.06450
.07100

P =
232, 111 ω
270,000

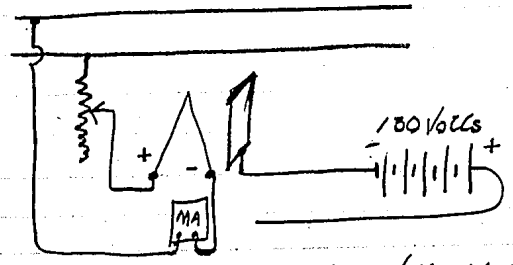
Further Experiments with Edison Effect using B Battery.



.002857
.000571 4

Current thro filament	Differ.	V without B. Battery	Diff	V. with 33 Volt B. Batt	Diff
160		.5		1.5	
165	.005	1.25	.75	3.9	2.4
170	.005	3.	1.75	7.5	3.6
175	.005	6.1	3.1	14.1	6.6
180	.005	11.8	5.7	26.5	12.4
185	.005	17.	5.2	37.	10.5
190	.005	23.	6.0	51.5	14.5
195	.005	31.	8.0	65.5	14.0
200	.005	37.	6.0	93	27.5
205	.005	39.5	2.5	112.5	19.5
210.	.005	42.	2.5	124.	11.5

Further Experiments with Edisons Effect.



Filament Current	Volts, Plate to + Filament	Volts, plate +130 volt batt, to + filament		Volts, plate +130 volt batt to − filament.
.160	0	2	65	1.5
.165	1	3.25	68.25	2.5
.170	3	4.25	71.5	3.5
.175	5	7.50	76.25	7.
.180	7.5	12.50	81.	12.5
.185	11.5	19.50	84.25	17.
.190	19.5	37.00	87.5	26
.195	26.5	54.	91.25	32
.200	38	90	94	51
.205	46	101	98.25	63
.210	50	126	102.5	68.

Test of Diaphragms for Deflection under pressure.

Russian Iron

#1 = .0155 - .0145 - .0145 - 015

Diameter 2 5/32"

Pressure	On	Off	Difference	Set.
0	.167	.167		
5	.125	.167	.042	0
10	.118	.167	.049	0
15	.110	.167	.057	0
20	.107	.166	.059	.001
25	.101	.166	.065	.001
30	.096	.167	.071	0
35	.088	.131	.043	.036
40	.082	.120	.038	.047
45	.076	.111	.035	.056
50	.067	.095	.028	.072
55	.059	.084	.025	.083
60	.051	.076	.025	.091
65	.048	.069	.021	.098
70	.040	.040	0	.127
75	.025	.045	.020	.122
80	.025	.043	.018	.124
85	.020	.039	.019	.128

Russian Iron

#R = .0205; .020; .020; .0215

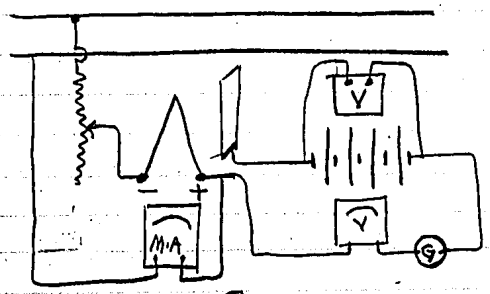
DIAMETER R 5/32"

Pressure	On	Off	Difference	Set
0	.154	.154		
5	.138	.153	.015	.001
10	.127	.152	.025	.002
15	.121	.151	.030	.003
20	.116	.150	.034	.004
25	.111	.150	.039	.004
30	.105	.146	.041	.008
35	.100	.141	.041	.013
40	.093	.126	.033	.028
45	.086	.119	.033	.035
50	.080	.108	.028	.046
55	.073	.099	.026	.055
60	X .026	.060	.046	.094
65	.046	.060	.026	.094
70	.045	.058	.013	.096
75	.044	.057	.013	.097
80	.041	.055	.014	.099
85	.037	.052	.015	.102
90	.032	.047	.015	.107

Russian Iron
#3 = .027 - .027 - .0265 - .0265
Drameter 2 5/32"

Pressure	On	Off	Difference	Set
0	.150	.150	0	
5	.158	.150	.018	0
10	.132	.150	.018	0
15	.127	.150	.023	0
20	.125	.150	.025	0
25	.120	.149	.029	.001
30	.116	.148	.032	.002
35	.113	.147	.034	.003
40	.109	.1465	.0375	.0035
45	.105	.146	.041	.004
50	.102	.145	.043	.005
55	.097	.139	.042	.011
60	.092	.132	.040	.018
65	.090	.126	.036	.024
70	.0865	.124	.0375	.026
75	.081	.114	.033	.036
80	.077	.109	.032	.041
85	.073	.100	.027	.050
90	.067	.093	.026	.057

Further Experiments with Edison Effect.



1 Filament Current	2 Volts, + filament to plate	3 Volts necessary to reduce col. 2 to 0.
.160	✗ .75	65.
.170	✓ 3.	71.5
.180	✓ 9.	81.
.190	✓ 20.	87.5
.200.	✓ 38.5	94.
.210	✓ 49.5	102.5
.214.	✓ 52.	106.5

Test of Diaphragms for Deflection under Pressure

#4 Mica
.010
Diameter 2 5/32

Pressure	On	Off	Difference	Set
0	.192	.192	0	0
5	.150	.192	.042	0
10	.143	.192	.049	0

Burst at 15 pounds

Test of Diaphragms

#5 Mica
.0175
Drameter 2 5/32"

Pressure	On	Off	Difference	Set
0	.180?	.180?	0	0
5	.160	.184	.024	0
10	.150	.184	.034	0
15	.145	.184	.039	0
20	.142	.184	.042	0
25	.1375	.184	.0465	0
30	.131	.184	.053	
35	.			

Burst at 35 pounds

Test of Diaphragms

#6 Mica
.022
" Diameter 2 5/8"

Pressure	On	Off	Difference	Set
0	.182	.182	0	0
5	.166	.182	.016	0
10	.159	.182	.023	0
15	.150	.182	.032	0
20	.145	.182	.037	0
25	.141	.181	.040	.001
30	.138	.181	.043	.001
35	.133	.181	.048	.001
40	.130	.181	.051	.001
45	.127	.181	.054	.001

Burst at 50 pounds

Test of Diaphragms

#7 German Silver .0105
" Diameter 2 5/32"

Pressure	On	Off	Difference	Set
0	.190	.190	0	0
5	.145	.190	.045	0
10	.135	.190	.055	0
15	.134	.190	.056	0
20	.121	.185	.064	.005
25	.111	.175	.064	.015
30	.102	.150	.048	.040
35	.090	.130	.040	.060
40	.065	.100	.035	.090
45	.052	.083	.031	.107

Burst at 50 pounds

Test of Diaphragms

#8 German Silver .020
Diameter 2 5/32"

Pressure	On	Off	Difference	Set
0	.188	0	0	0
5	.163	.188	.025	0
10	.152	.183	.031	.005
15	.147	.183	.036	.005
20	.139	.183	.044	.005
25	.133	.182	.049	.006
30	.128	.182	.054	.006
35	.125	.182	.057	.006
40	.122	.182	.060	.006
45	.117	.182	.065	.006
50	.112	.181	.069	.007
55	.107	.177	.070	.011
60	.102	.170	.068	.018
65	.097	.153	.056	.035
70	.091	.140	.049	.048
75	.084	.129	.045	.059
80	.079	.118	.039	.070
86	.071	.108	.037	.080
91	.066	.094	.028	.094
95	.055	.087	.032	.101

Preliminary Tests at Sandy Hook.

① Using transmitter #3 with break and 2 cells battery and with receiver #2.

In water, hear to 12"
In air, hear to 26"

---

② Same as 1 but using receiver #1 in place of #2

In air hear to 26".
In water hear to 12"

③ Transmitter #1
Receiver #1
Hear in water to 45'

4/4/17 Weather - warm & fair

Put impedance in 1st audion B battery line.

At Sandy Hook

4/5/17

Set up Audion Det.

① Using head Conrad Nere. Noise, slight roaring with slight reel noise. Cuts out at 52

② Put impidance coil in B battery circuit. Chumps badly.

4/5/17. Weather Cool. Heavy Winds. Rain & Storm in afternoon and night with some sleet.

Booth Dairy Guest

4/6/17.

Weather Boistrous, cloudy, foggy, sea choppy—cold.

Heard this morning at breakfast that war was declared at 3:30 a.m.

① Test to determine noise of waves. Made from dock. Receiver #1, head 2" under trough of waves.
Without audion hear noise to 18.

② Same as 1 but with audions. Hear noise to 60

This noise is a roar mixed with clicks of varying intensity.

③ Same as 1 but with receiver #2 at various depths. No audions.
Trough of waves.
Noise slight hear to 8
½ pole length 18" 16
At surface again 10
½ pole length 18" 14
1 pole length 36" 18
1½ " " 4½' 16

Cliff

#2 Receiver less sensative than #1.
Suggest U tube to equalize pressure.

2 pole lengths	6'	12
2½ " "	7½'	10
3 " "	9'	12
4 " "	12'. Noise changes here. can not hear the flow of water, but hear rather the dash of waves against dock	12
5 pole lengths	15'	12
6 " "	18'	12
7 " "	21'	10
8 " "	24' (on bottom)	10

11:35 Am.
Tug came in around point to land mine material.
Connected on audions with #2 receiver. Could hear engines plainly at 500 yards. Could hear them slow down and then stop when for making landing at about this distance.
Did not hear propellers but could hear the jar or clash of engines as the pistons move up and down.

With audions in, the noise is terrific without the receiver shunt boxes.

At 60 the smaller noises are strained out and only the mean dash against the piling can be heard.

It will be necessary to strain out extraneous sounds.

Suggest N.E. Electrical Method.

(4) Same as (3) but with audion connected up.

at surface	noise to	60
1½'	under surface " "	60
3'	" " " "	60
6'	" " " "	60
9'	" " " "	60
12'	" " " "	60
15'	" " " "	60
18'	" " " "	60
21'	" " " "	60
24'	" " " "	60
3'	" " " "	60

not as loud

- only little louder than at 24'

Pounding of waves against pier, rocks it and makes an awful sound.

4/7/17.

Weather - Stormy, cloudy in morning! clear in afternoon heavy wind and rough sea all day.

On arrival back with rope, swung #3 receiver out and made preliminary noise test.

① Noises are - a continuous roar and intermittent scratching sound. The roar, I think is the combined noises of, white caps, waves against piers, piles etc. The scratching, the motion of water in the funnel against the diaphragm.
Noise or not to 60.

② Without audion, swung #3 receiver.
Noise - could not hear anything.

To make sure that there was nothing wrong with ②, connected

The air tube to #3 receiver has broken loose twice. For this work, it will be necessary to make all fittings, strong and rigid so as to stand the impact of the waves, and rough handling of swinging overboard.

#2 Receiver also has case ~~over~~ ~~stressed~~ ring over the diaphragm which clamps it so tight that we can not remove.

Our facilities for repairs here are less than in Lab so that parts should be designed to be readily repaired.

through with transmitter and receiver. Could hear through O.K.

③ To test circuit of ②, drew #3 receiver up out of water and talked through it. Could hear both with direct circuit and through audions.

④ To test and see if audions were working well, connected a Bell receiver as transmitter in audion line. The high wind and dash of waves outside made a terrific noise over this. Speaking close was too loud to transmit. Speaking at 24" was as close as articulation could be distinguished. Seemed to show that audion circuit is O.K. and very sensative.

⑤ Disassembled Receiver #3 to see if O.K. Found Chatterton compound around air tube

It is evident that theory of sound being only about 1/60 amplitude in water holds good.

We should therefore have transmitter which will give 60 times the electrical impulse as present one.

This may possibly be accomplished by having a heavier diaphragm and adjusting much closer.

cracked, tube loose, diaphragm showing effects of electrolysis. Took apart, dried out and vaselined all iron parts and reassembled.

⑥ Tested out receiver #3 by talking in it. Found it O.K., apparently louder than ③, both direct and with audions.

⑦ Put #3 receiver under water. Noise less than ①, sounds clearer & cleaner.

⑧ Used transmitter #2 to receiver #3.
Could hear clearly at 6' and at 50'.

4/8/17 Sunday

Weather - Morning - cold, cloudy rough. afternoon, wind became less and sea calmed down so that we went out in boat.

Got new boat from coast guard.

Two guards volunteered and with Dawson went out.

① Used Transmitter #2, Receiver #3.

① At	50 yards	Heard plainly
"	100 "	" "
"	200 "	" "
"	500 "	" "
"	750 "	"
"	850 "	not sure could not distinguish.
"	1000 "	

The slap of waves is so like the clanking of the fuel that it is difficult to distinguish.

Transmitter #3 is evidently very weak as compared with #2. It sounds too much like the general noises. Do not distinctive enough.

② Using transmitter #3 receiver #3.

at 50 yds	could not hear
Back to 1 yard	Hear plainly
at 10 "	Hear
at 20 "	Just Hear
at 30 "	Can't Hear

③ I went out in boat and sounded bell, 3 taps - 1 second interval & 3 more. Dawson listened.

100 yds	heard
200 "	"
300 "	"
500 "	"
600 "	"
750 "	"
900 "	"
1000 "	"
1200 "	"
1400 "	"
1500 "	"

Signalled me to come in because I was getting near strong current which would carry me to Ridgeland.

⑭ Tread break wheel in input circuit. Noises come with it making it prominent. Also the air gap break outside booth makes so much noise it disturbes readings inside booth.

4/9/17.

Weather - Very cold - Fair - High Winds - Rough Sea all day.

Scaled map to locate distance points in testing.

① Dawson & Moore went out in boat taking transmitter #2. Used Receiver #2.
Noise of waves so loud could not distinguish at 100 yds. Wind so high & waves so rough could not stay out.

Notes. 4/14/17

1750 / 500 = 11 ; 1750 / 15760 = 9

4/14/17.

Weather - clear, mild, very little sea.

Position - Off Red Bank, in N. Shrewsbury R

Using - Tranamitter #2 (E^b Beel).
Receiver #3 with Tunnel.
Depth of water at Receiving boat 8ft.

(1)

① Position Trans. Boat (Red Buoy)
Depth water 21½ ft
Distance from Receiver 700 yds.
Hear to Hear plainly

② Position Between Boat House & Bet. McClees Creek
Depth 10 ft
Distance 1575 yds
Hear to Could not hear

③ Position
Depth
Distance
Hear to

4/7/17.

Same as previous page except now boat used to get small intervals.

③	Low	60
	High	60
		100 yds
		9'
④	Low	50
	High	60
		250 yds
		9'
⑤	Low	46
	High	60
		650
		10'
⑥	Low	40
	High	60
		450
		9'

Can hear launch going away for about 300 yards.

Rope noise prominent must find a better means of suspension.

⑦ Low 32
High 58
600
12'

⑧ Low (Wind coming up getting choppy out) 12
High 40
700
21'

⑨ Low (S & Wind) Turned Boat 6
High Choppy Out 30
850
18

⑩ Low 4
High 16
1000
15

(12) Low
High

Can only occasionally hear
" " " hear at 10
1200
18

4/15/16.

Because of short distance readings yesterday, as day was fair with only slight wind, decided to make readings in the bay from Atlantic Highlands pier towards Fort Hancock wharf to-day.

Found moderate N.W. wind producing more waves than anticipated.

Dent out boat. Sea too high.

Came in made for buoy at Red Bank.

(13) Low 56
High 60

(14) Low } Lost this reading. Rough
High }
boat had gotten out into shallow water so that reading was gradually lost.

Notes —

① Can not hear behind banks

② Probably a pair of good head telephones removed be better with this outfit Than single head phone as it moved be more sensitive & cut off other ear

⑮ Back to 100 yds in channel
① Low 60
② High 60
100 yds
80'

⑯ Low 60
High 60
200 yds
15'

⑰ Low 48
High 60
~~200~~ yds
14'

⑱ Low 20
High 36
~~400~~ yds
14

wind

Break Wall
Side of Horn

(19) Low
High Wind coming up making noise about & below water

10.
36
600 yds.
18'

(20) Low
High. High Wind much noise

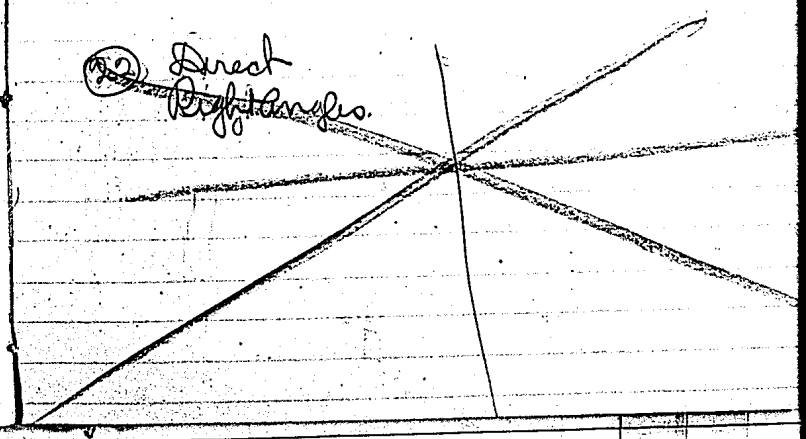
0.
14.
600 yds.
11'

---

(21) Direct
Rightangles

40
42

(22) Direct
Rightangles.



Tests to make

A. Distance 1. Outside in bay
2. At Red Buoy
3. From Point
to determine effect of depth of water.

B. Distance can hear with horn pointing at source of sound and sideways to source to determine effectiveness of horn as a direction finder.

C. Test relative loudness of Transmitters 1, 2, and 3.

D. Make up buoy and anchor to try leaning #3 horn outside and away from boat to eliminate noise

4/16/17.

A. Drew stern of tender out of water & packed stuffing box.
B. Put new dry batteries in tender.
C. Exchanged wheels in audions. This out seems to be quite sensative.

Moderate N.W. wind made river choppy. Ran over to cove on opposite side of river to get short distance readings and to test out sensativeness of audions.

Transmitter #3
Receiver #3 with funnel

(22) 25 yds
Low 60
High 60

(23) 25 yds
Low 60
High 60

75 100 30

During previous reading wind was quiet. Dropped down to 100 yds but wind had puffed up. Could ~~not~~ hear.

Noise is a great factor in the game.

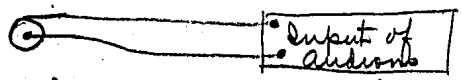
(24) Let Row boat drift out carrying #3 transmitter. Could hear to about 75 yds, Could not distinguish beyond this.

(25) Then sent out row boat on end of line to 55 yds. Found that by interchanging leads 1 and 2 on audions could get sound a little clearer & cleaner

(26) A Connected up break wheel in input circuit, having #3 transmitter and funnel connected in

On running break wheel, got very great noise, too much for use.

B Then took out #3 horn, running only break wheel in input circuit.



Still got noise from this.

C Then changed from lead covered input as advised by W.E. Co to straight twisted pair as previously used in Lab. On connecting up and running as B, got no noise from break wheel. This noise was evidently obtained by alternate charge & discharge of the sheath.

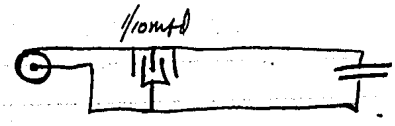
D Then put lead sheath input back on and grounded the sheath. Diminished noise only slightly.

It is evident that when break wheel is used on one side of line as in this case, lead covered wire

can not ~~be used~~ as input in spite of W.E. Co. advice on this.

E Found resets in C and D to be mistaken - reason being ~~that the~~ input wire substituted for lead sheathed input was short circuited. On using well insulated pair, the break makes considerable noise with regular twisted pair, not quite as much as with lead covered however.

F. Added 4 mfd condenser around 1/10 mfd. at present around break



This reduced the noise of the break slightly.

27. Using #3 Receiver with funnel and with break behind using air-break, ran tender down stream directly away from horn. Could not distinguish propeller noise from other sounds and noises coming from wheel shaft. On removing break could hear chug, chug of engine for about 200 yards

28. Experiment to compare bells 1 and 2.
At 500 yds — Low
Hear #1 to 32
" #2 to 38

29. Same as 28 but to 400 yards
Hear #1 To 28
" #2 To 34

30 Same as 29 but to yds

Set #1 to 18

" #2 to 28

31 Same as 30 but to yds

Set #1 to 2

Set #2 to Low 6

" " 2 " High 14

32 Test of horn pointed direct and at right angles.

600 yds.

#2 Transmitter

#3 Receiver with funnel

Direct at

Right angles 5 5 8

C155

4/17/17.

Beautiful day without wind or waves.

Took readings about 150 yds off pier at Sandy Hook.

Used Transmitter #2 - (Large E[b] Bell)

Receiver #3 with Funnel

(33)[A] Distance (250) (750)

Low 60

High 60

Hear overtones of bell both close up and at this reading.

(34) B Distance (500) (1700

Low 60

High 60

Hear the engine & propeller of a tug both on "low" and high", more than a mile away.

Set readings with thicker diaphragm

#3. with and without funnel.

(35) C Distance 900 (1750)
Low 54
High 60
Still hear tug though she is abt busy off Lynx Knoll 3500 yds away.

(36) A Distance 1400 (2000)
Low 40
High 52
Can not hear tug on low but can still hear on high although she is out of sight around Sandy Hook point.

(37) E Distance 1800 (2250)
Low 28
High 44

Tug and all regular sounds now lost. Only noise is roar of Harbors. The ideal day for work.

38 F Distance (2700) (3100)
Low 18
High 38

39 A Distance 2600 (3000)
Low 20
High Did not get
(Mistook signals and had to stop.)

S.W. breeze started up here. Sea like glass before.

Sea piled up before S.W. Breeze.
Ran in to Red Bank and anchored near Red Buoy.
Made Tests of comparative values with reeves #3, funnel off and on.

(40) Transmitter #2. Large E° Bell

100 yards
With funnel low 60 high 60
Without " " 38 " 60

200 yards
With funnel low 28 high 44
Without " " 30 " 52

300 yards
With funnel low 22 high 38
Without " " 16 " 34

Repeated experiment

100 yards
With funnel low 54 high 60
Without " " 18 " 36

200 yards
With funnel low 42 " 54
Without " " 4 " 22

300 yards
With funnel low 24 " 42
Without " " 0 " 6

0 ← can not distinguish

4/18/17.

On arrival back from Orange, the weather being fine, went out and anchored off U.S.C. Pier in Sandy Hook Bay.

Made series of tests to find relative loudness of #3 Receiver pointed direct at source of sound and at 90° from it.

These tests proved unreliable. Reason later found to be that the second Receiver was on "low" in place of high and all readings were too low.

Made also series of tests to find comparative values of #1 & #2 transmitters with same results.

During this time the wind had come up making the bay somewhat rough.

Late in afternoon made following tests:

Tests to determine relative values of #3 Receiver with funnel pointed directly at source of sound (#2 Receiver) and pointed 90° from direction of source

(41)

500 yards.

Pointed at Source	Low	60
	High	60
90°	Low	46
	High	60

800 yards.

Pointed at Source	Low	34
	High	58
90°	Low	24
	High	50

1200 yards

Pointed at Source	Low	22
	High	36
90°	Low	could not distinguish
	High	Could not distinguish

2000 yards

Pointed at Source { Low — could not distinguish
{ High — "

Since this was the limit, did not try 90°.

This test not thoroughly satisfactory because boat was rocking badly & noisy.

Reason was she was anchored broadside to the wind and waves.

{1111}

4/19/17

Yesterdays results confusing. Not reliable. Determined to try over today.

Rained little last night. Started down river in S.W. blow but found it rather quiet at Ft. Hancock Bar. anchored about 150 yds 11 o'clock from this.

(42) Transmitter #2
Receiver #3 with funnel

A = 500

Direct	Low	60
	High	60
90°	Low	54
	High	60

B = 1000

Direct	Low	52
	High	60
90°	Low	44
	High	60

C = 1500

Direct	Low	54
	High	60
90°	Low	44
	High	60

Can hear launch engine at this distance.

D = 7000

Direct	Low	36
	High	58
90°	Low	36
	High	56

E = 2800 Brass Landing gear makes noise

Direct	Low	24
	High	46
90°	Low	24
	High	50

F =

Direct	Low	can not distinguish
	High	at all.
90°	Low	
	High	

Test for difference with funnel.
Transmitter # 1.
Receiver # 3- without funnel.

(43)

A = 500 yds
Low 26

B = 1000
Low 10

C = 1300 yds
Low 2 Limit

Put funnel on.

C = 1300
Low 4

Very much more noisy.
Tide running strong now makes
them noisy. I think first
figure is correct however.

C1753

To confirm previous

Transmitter # 1
Receiver # 3 with funnel.

A = 500 yds Low — 16

B = 1000 yds Low (less noise than A) — 14

C = 1500 yds Low — Limit — 2

Funnel Off

C = 1500 yds Low — 2

B = 1000 yds Low — 12

A = 500 yds Low — 12

4/20/17-

Assembled small dinner bell (Transmitter #4) for short distance use.

Ran to Sandy Hook to take readings.

Saw Capt. Bettison who referred me to Capt. Berry about position for making deep water tests outside Hook.

Got message from Irwin to come back to Red Bank immediately.

Message at Red Bank. Father unconscious - very low.

4/18/17.

Returned last night from Montgomery to Orange & got to Red Bank this morning. Dan Dawson & Taylor, found Rat Tripod had been finished, went out to try it out.

Weather Fair. Fair wind from N.W. Rather heavy swells in bay.

Used -
Transmitter #2 - Eb Bell
Receiver #3 with funnel, mounted on tripod. Rowed to bottom about 50 yards from Launch.

Readings

(44) A = 600 yards.
Low 60
High 60
Board Launch on low easily to B.
B = 1200 yds
Low 60
High 60

C1813

Heard our tender ~~to position~~ C.
High powered motor boats came by. Could hear to about 1500 yds. at right angles to horn.

C = 1800 yards.
Low 56
High 60

Tramp Steamer came in from Ocean. Could hear engines easily to 4000 yards. They gave the sound -L ___ --L-- --- ,

D = 3000 yards.
Mistakes in signals and constant interference by a tug, two paddle wheel steamers and a power sail boat made this reading impossible.

We have two difficulties to contend with & need to overcome
(1) means of finding true distance or range
(2) need of apparatus & method of signaling two 3000 yds & mo

- NOTE -

Discrepancies between Dawsons readings and mine may be because of use of different bells. Dawson took single and effect of funnel readings with #4 ondale dinner bell. I took readings with #2 - large bell.

It is also evident that for quantative readings, the sensativeness of apparatus is largely influenced by the current flowing through the filiments. We have not been careful in the past of this.

4/30/17

Weather - Cold, blustery, high wind from S.E - Boat rocks. Could not use horn from boom in such weather

Transmitter #2 (E° Bell)
Receiver #3 with funnel, anchored 50 yds from boat on tripod

(45) A =

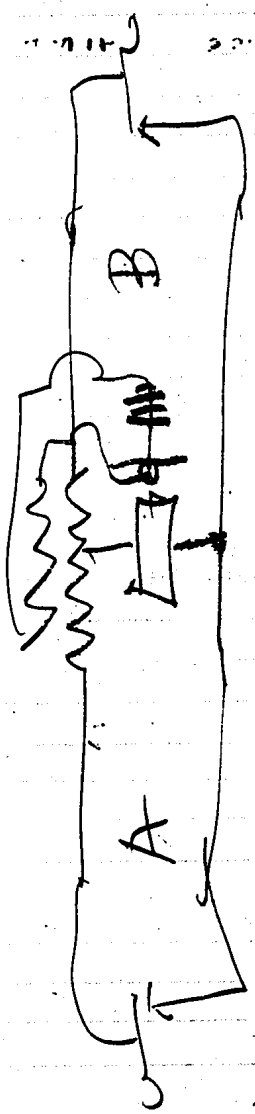
Low 60
High 60

I can not hear launch at position B today though I could Saturday.

B =

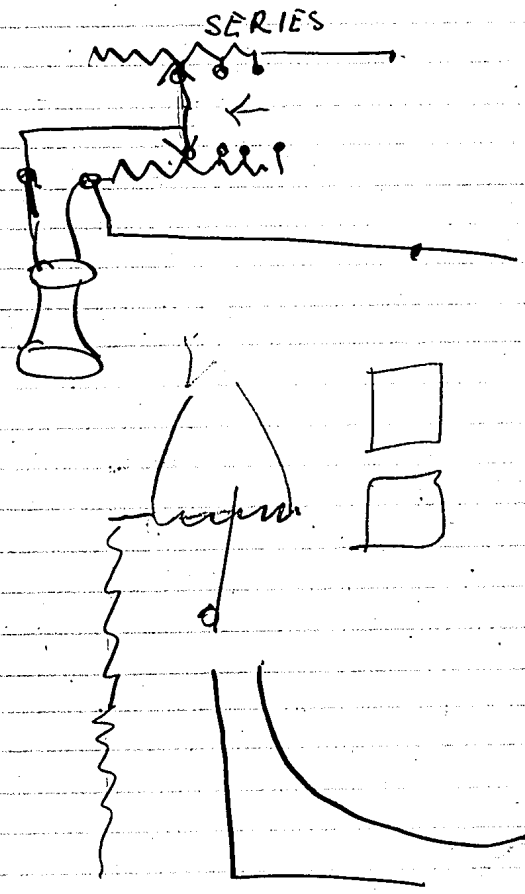
Low 28
High 48

Hear a tug - also Borden high powered boat. Disturbs readings.



RECEIVER — SHUNT

SERIES



Bomb dropping test interfered so much decided to move up bay opposite point.

Transmitter #1 (Bell small B?
Receiver #3 with funnel – from boom

(H6) A

Straight	Low	24
	High	46
90°	Low	14
	High	52

Repeated above

Straight	Low	26
	High	54
90°	Low	26
	High	46

Dawson Readings on same.

Straight { Low 28
{ High 40

90° { Low 18 (24)
{ High 36

Took second time

Straight { Low 28
{ High 54

90° { Low 24
{ High 50

C90

Then tried effect with & ~~without~~ funnel —

(47) ~~1500~~ yards
Transmitter # 1 (1st Rec
Receiver # 3.

With funnel hear to
Low 32
High 52

Without funnel hear to
Low 14.
High 34

Order from Orange

4 Hard Rubber Blocks
having 2 Fahnstock connectors
each.

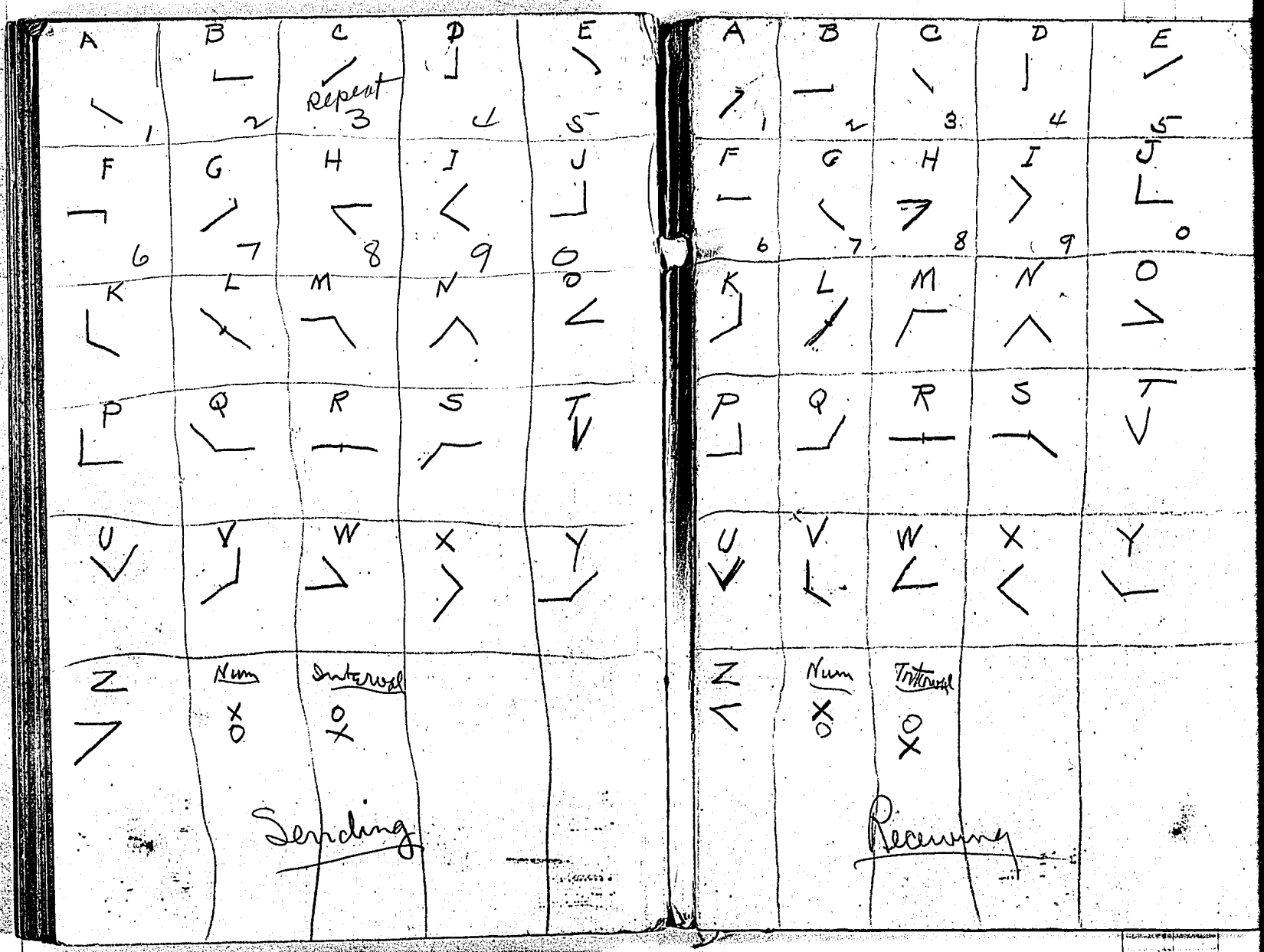
1 box each size double
pointed tacks

Suggestions & Notes on Apparatus

① Trouble from water in back of diaphragm largely if not entirely removed by new large tube at bottom and small orifice above.
Suggest that this tube be well vaselined to prevent capalarity.

② Suggest that all parts be well vaselined in sending out, especially iron or steel. This will prevent rust and water staying in.

③ Suggest large bulb with thin rubber diaphragm to prevent water getting in back of diaphragm and at the same time equalize the pressure.


A
B
C
Repeat
3
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
Num
Interword
Sending
A
B
C
D
E
F
G
H
I
J
K
L
M
N
O
P
Q
R
S
T
U
V
W
X
Y
Z
Num
Interword
Receiving